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FIVE YEARS OF RESEARCH IN TELEVISION INSTRUCTION IN THE CINCINNATI PUBLIC SCHOOLS, 1955-56 THROUGH 1959-60.

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A SUMMARY IS GIVEN OF 13 EXPERIMENTS IN DIRECT INSTRUCTION BY TELEVISION IN BIOLOGY, CHEMISTRY, ELEMENTARY SCIENCE, DRIVER EDUCATION, AND MATHEMATICS. IN ADDITION, FOUR EXPERIMENTS CONDUCTED DURING THE 1959-60 SCHOOL YEAR ARE ABSTRACTED IN GREATER DETAIL. (MS)

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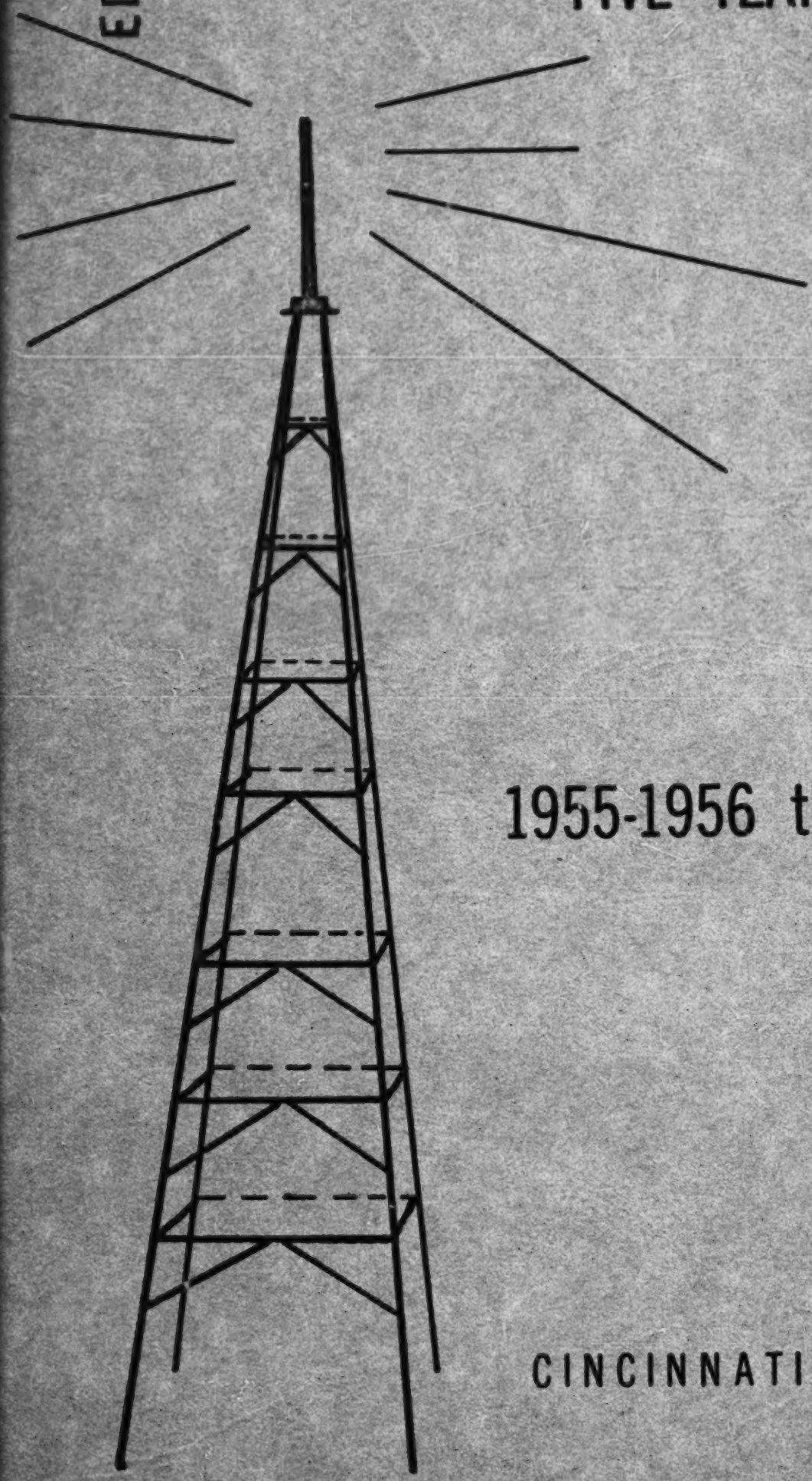
FIVE YEARS of RESEARCH in the USE of TELEVISION in INSTRUCTION



1955-1956 through 1959-1960

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CINCINNATI PUBLIC SCHOOLS

SEPTEMBER, 1960

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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FIVE YEARS OF RESEARCH IN TELEVISION INSTRUCTION IN THE CINCINNATI PUBLIC SCHOOLS, 1955-56 THROUGH 1959-60

Summary and Generalizations

Division of Instructional Evaluation

Department of Instruction

Cincinnati Public Schools

September, 1960

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FOREWORD

After five years of experimenting with the use of television in direct instruction, it is not only pertinent but necessary to review the findings in order to find answers to the question "Where are we going in educational television in the Cincinnati public schools?"

It may be said that educational television in the Cincinnati schools consists of two types: enrichment and direct instruction. Each year many worthwhile enrichment programs are telecast. For example, during 1960-61 over 250 enrichment telecasts will be presented, some of them to be repeated. These are prepared for grades from kindergarten through the twelfth in a wide variety of subjects such as arithmetic, science, reading, and physical education. Many teachers and supervisors attest to the value of these telecasts in the instructional program; yet by the very nature of enrichment programs, conclusions based on any formal evaluation necessarily would be tenuous.

Over the past five years thirteen experiments in direct instruction by television have been conducted in the school system in biology, chemistry, elementary science, driver education and mathematics. The course of study in each subject was followed in preparing the telecasts, and each of the experiments was designed to be evaluated formally.

On the following pages a summary of the thirteen experiments is presented, together with a discussion of the implications of the results. In addition, abstracts of the results of four experiments conducted during the past school year (1959-60) are included at the end of the report. Since each of these four experiments in a sense represented a follow-up or continuation of an earlier experiment, a somewhat more detailed summary seemed appropriate. It should be noted, however, that the detailed technical descriptions of these four experiments are contained in a separate report soon to be published.

It is hoped that this summary and the three detailed technical reports published over the past three years will aid in making the best possible decisions regarding the future use of television instruction in the Cincinnati public schools.

ROBERT P. CURRY
Associate Superintendent

September 1, 1960

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SECTION I

SUMMARY AND GENERALIZATIONS AFTER FIVE YEARS OF RESEARCH IN TELEVISION INSTRUCTION IN THE CINCINNATI PUBLIC SCHOOLS, 1955-56 THROUGH 1959-60

The school year 1959-60 represents the fifth consecutive year of studying the merits of direct instruction by television in the Cincinnati public schools. A total of thirteen experimental-type studies have been completed and reported in detail. What has been learned from these experiments? What generalizations have been derived that will serve as guide lines in the future use of television? Since the answers to the first question will determine the answers to the second, it is appropriate to summarize the findings to date. This summary is shown in Table 1.

There are several important factors to be noted before any general interpretations are made. First, it should be noted that with few exceptions the experiments have been conducted with separate classes of average size viewing television within their own classrooms. This feature is unusual among many large cities which have focused their attention on large class instruction.

Second, with the exception of only one experiment, television instruction has been used in conjunction with classroom instruction. The proportion of television time to total instructional time has varied from one experiment to another, but typically television has been used on an every-other-day basis and usually represented from one-fourth to one-third of the total instructional time. The term "television instruction" as used here, therefore, represents a combination of classroom and television instruction.

Third, it should be recognized that the primary criteria for judging the effectiveness of the method of instruction have been subject matter tests. In most instances, these have been standardized achievement tests, although in some experiments, such as driver education, tests had to be developed locally because of the lack of valid standardized tests. Obviously, tests do not measure all educational objectives. Perhaps they

Table 1. A Summary of Thirteen Experiments in the Use of Television in Direct Instruction in the Cincinnati Public Schools, 1955-56 through 1959-60.

Courses Taught by Television and Grade Level	Length of Time Taught and Year	Frequency of Telecasts and Proportion of Instructional Time	Results of Experiments
Science 5th Grade	One School Year 1959-60	Televised lesson every other day for 20 minutes followed by 10 of discussion. Television was 33% of total instructional time.	Conventional instruction was superior to TV for average and below average ability pupils. Both methods equally effective for above average pupils.
Science 5th Grade	4 Weeks 1959-60	Same as above.	Pupils taught by television under conditions conducive to high versus low involvement achieved equally well. The high involvement techniques tended to be less favored, particularly by above average ability pupils.
Science 6th Grade	One School Year 1958-59	Televised lesson every other day for 30 minutes followed by approximately 5 minutes of discussion. Television was 50% of total instructional time.	Conventional instruction was superior to TV for below average and average ability pupils. Both methods were equally effective for above average pupils. Most pupils preferred televised instruction, although this preference was conversely related to mental ability. Teachers felt TV to be an asset to education but were evenly divided in their opinions on issues such as personal satisfaction, amount learned by pupils, and whether they would engage another class in TV instruction.*
Science 6th Grade	8 Weeks 1956-57	Televised lesson every other day for 30 minutes with no further classroom instruction. Television was 100% of instructional time.	Televised instruction was more effective with above average ability pupils; no significant differences in methods of average ability pupils; conventional instruction more effective with below average ability pupils.

*These views were obtained not only from 6th grade science teachers but also from 7th grade mathematics and 9th grade biology teachers.

Courses Taught by Television and Grade Level	Length of Time Taught and Year	Frequency of Telecasts and Proportion of Instructional Time	Results of Experiments
Mathematics 7th Grade	One School Year 1958-59	Televised lesson of 20 minutes every M-W-F followed by 30 minutes of discussion. Television was 24% of total instructional time.	Conventional instruction superior for above average ability pupils; TV instruction superior for average ability pupils; both methods equally effective for below average ability pupils. Most pupils preferred TV instruction but preference conversely related to mental ability. Pupils taught conventionally by same teacher who viewed telecasts achieved no better than pupils whose teacher did not view telecasts. No evidence, therefore, of in-service teacher growth as measured and defined.
Mathematics 7th Grade	One School Year 1959-60	Televised lesson of 20 minutes every M-W-F followed by 30 minutes of discussion. Television was 24% of total instructional time.	Telecasts directed only to pupils 1 1/2 to 2 1/2 years retarded in mathematics. Pupils homogeneously grouped for instruction. Both methods equally effective in imparting computational skills. Two out of five comparisons favored TV instruction in problem solving and concepts achievement, while the remaining three comparisons showed no significant difference.
Biology 9th Grade	One School Year 1957-58	Televised lesson every other day for a full 50-minute period. Lab and discussion on non-TV days. Television was 50% of total instructional time.	Television method more effective with above average ability groups; no difference in methods at average ability level; conventional instruction more effective with below average ability groups. Knowledge about science and scientists developed equally well by both methods. Most pupils showed a definite preference for conventional instruction.

Courses Taught by Television and Grade Level	Length of Time Taught and Year	Frequency of Telecasts and Proportion of Instructional Time	Results of Experiments
Biology* 9th Grade	One School Year 1958-59	Televised lesson every other day for 30 minutes followed by 20 minutes of discussion. Television was 30% of total instructional time.	Television methods was uniformly more effective than conventional instruction on subject matter tests. Knowledge about science and scientists developed equally well by both methods. Below average ability pupils tended to prefer television instruction, while above average pupils preferred conventional instruction. No difference in preference for average ability pupils.
Biology 9th Grade	---- 1959-60	Retention study of pupils who participated in 1957-58 biology experiment. An alternate test was administered.	Both methods of instruction resulted in an equal degree of retention after approximately two years. Gains made by above average pupils taught conventionally suggest that transfer of learning may be more possible under conventional methods.
Driver Education** 10th Grade	Three Experiments, each one semester, 1956-57 1957-58	Televised lesson every class period for 30 minutes followed by 20 minutes of discussion. Classes met every day (1/2 unit course). Television was 60% of total instructional time.	Exp. 1 - Television method more effective in general. Exp. 2 - Television method more effective with above average ability pupils who in turn tended to prefer some form of televised instruction; conventional method more effective with below average ability pupils who in turn tended to prefer conventional instruction. Exp. 3 - Television method more effective with above average ability pupils; both methods equally effective with below average ability pupils.
Chemistry 12th Grade	7 Weeks 1955-56	Televised lesson every other day for 40 minutes followed by 10 minutes of discussion. Television was 40% of total instructional time.	Television method was more effective.

*Two classes met together for TV instruction but met in separate classrooms on alternate non-TV days.
**Telecasts and discussion occurred in large class situations of over 150 pupils.

do not measure even the most important educational objectives. The important areas of pupil attitudes, interests and actual behavioral changes, for example, have been studied only to a limited extent because of the difficulties in measuring these attributes and the high costs in terms of time, money and personnel.

Finally, it is important to make a distinction between educational significance and statistical significance. The statistical significance of differences between instructional methods or any experimental variables is based on distributions of various statistics and tested within certain confidence limits. Statistical significance is verifiable, reproducible and commonly accepted. The determination of educational significance, on the contrary, relies primarily on sound judgment. Educational and statistical significance do not necessarily go hand in hand, although the latter is usually required as a minimum before educational significance is judged. One individual, therefore, may judge a statistically significant difference between television and conventional instruction as educationally significant, while another may not view this same difference as large enough to be educationally significant.

With these considerations in mind, attention may be turned to Table 1 which summarizes the results, based on statistical evidence. Several generalizations as they relate to these experiments become evident upon inspection of this information.

Generalizations

1. Neither television nor conventional instruction tends to be consistently more or less effective for all pupils and for all courses.

2. When subject matter achievement tests are used as criteria, there is a trend for televised instruction to be more effective than conventional instruction for older pupils at higher grade levels. Conversely, conventional instruction tends to be more effective with younger pupils at lower grade levels.

3. Television instruction tends to be more effective than conventional instruction with above average ability students unless deliberate efforts are made to direct instruction to less able pupils. Conversely, conventional instruction tends to be more effective with less able students unless deliberate efforts are made to direct instruction to pupils at a below average ability level.

4. Ordinarily, pupils classed as average in ability tend to do as well on achievement tests by television instruction as by conventional instruction.

5. There is a negative relationship between preference for television and pupil ability level; that is, the more able pupils tend to prefer conventional instruction while their less able peers tend to prefer television instruction.

6. There is a negative relationship between preference toward television and educational grade level; that is, pupils in higher grade levels tend to prefer conventional instruction, while pupils in lower grade levels tend to prefer television instruction.

7. Teachers generally tend to look upon television instruction as an asset to education and feel that being a classroom teacher in a television situation is a valuable experience. They are evenly divided on issues such as personal satisfaction, amount learned by pupils and whether they would like to engage another class in television instruction.

8. Both methods of instruction seem to result in equal retention, although there is some evidence to indicate that transfer of learning occurs to a greater extent with the more able pupils taught in the conventional manner rather than by television.

9. Certain types of pupil involvement techniques used in television instruction do not appear to result in a higher degree of achievement than techniques less conducive to pupil involvement.

10. There is some evidence to show that reducing the length of the telecast may result in the telecast being more effective for the less able pupil.

Implications

The primary implication of these generalizations is that television instruction cannot be used indiscriminately for all pupils at all grade levels. This implication is based on statistical evidence. Educationally, this implication may be quite different depending upon what a school system wishes to gain from using television in instruction.

The Cincinnati public schools have used television primarily with one view in mind, the improvement of instruction. Experiments in Cincinnati which result in no significant differences, therefore, are in a sense

unfavorable toward television. On the other hand, when it is noted that television instruction in Cincinnati is characterized by excellent teaching and the best possible use of curriculum guides and visual materials, perhaps the lack of significant differences should be regarded as an encouraging mark of a generally high calibre of conventional instruction.

Further, in the matter of expecting significant differences favoring television, it is possible that in some situations such demands may appear unreasonable when it is observed that in only one of the thirteen experiments is the entire instructional time devoted to television. In five of the experiments television involved one-third or less of the total instructional time. Under such circumstances, the power of television would have to be great, indeed, in order for significant differences to be reflected in standardized achievement test scores.

A lack of significant differences also could be considered a favorable finding in a school system whose primary aim for television is to solve teacher shortages or reduce costs. It is possible that in the future it may be necessary for the Cincinnati community to adjust its goals and expectations for television instruction according to prevailing circumstances. For example, should teachers become unavailable in a given subject, the educational significance of television as a solution to a critical teacher shortage is obvious.

Televised instruction probably is not as effective as conventional instruction in terms of appealing to a wider range of ability. It is reasonable to presume that this goal is achieved most readily under the conditions characteristic of face to face classroom relations. It does appear, however, that television instruction is more effective when instruction is directed toward a specific ability level. Under such conditions, instruction tends to be more comprehensive and better oriented.

It is unfortunate that there seems to be no direct relationship between preference for televised instruction and achievement. The evidence seems to indicate, on the contrary, an inverse relationship. In these experiments preference for television has been highest among elementary school pupils and lowest among pupils in higher grades, while the former group tends to achieve better through classroom instruction and the latter through televised instruction. Furthermore, television seems to be generally more effective with brighter pupils; yet these same pupils prefer television least. How to solve this dilemma represents an important

problem for study, since most educators would agree that positive pupil attitudes are necessary in fostering a desirable atmosphere for learning.

There are at least four more important problems needing further investigation. First is the problem of identifying or developing television teaching methods and techniques which are powerful forces in learning. As a corollary, it is equally important to determine which of these methods and techniques are applicable to the various dimensions of individual differences. Although this problem is important to teachers in the conventional classroom, it is more important in television teaching because of the lack of continuous feedback necessary for adjusting immediately to individual differences.

A second problem is that of identifying or developing in more concrete terms the duties and functions of the classroom teacher receiving the telecasts. It is evident that the structure of a course on television is pre-determined in the sense that a classroom teacher cannot make immediate adjustments in the telecasts. In this respect, the classroom teacher must acknowledge a prescribed framework. Should the teacher stay within the framework, go outside the framework, or both? If so, under what conditions is the chosen alternative most conducive to learning?

Third, what are the optimum conditions for television instruction with respect to length and frequency of telecasts? Are shorter, more frequent telecasts more effective than longer, less frequent telecasts? Does the answer to the latter question depend on the age and maturity of pupils and the course being presented? Would better articulation between television and classroom teacher result if television instruction were presented in alternate five- or ten-minute blocks within a single class period?

Finally, does participation in a telecourse by a classroom teacher result in greater instructional effectiveness by that teacher in a conventional classroom setting? Subjective evidence seems to support this contention, while the limited objective evidence available does not. During the 1960-61 school year, two experiments have been planned to study the question of in-service teacher growth. The first experiment will present fifth grade language arts and social studies, while the second will present eighth grade English. Both telecourses will be designed for able youngsters. It is hoped that these experiments not only will shed some light on the question of in-service teacher growth but also provide further evidence on the efficacy of grouping for television instruction.

Further knowledge will be gained on the appropriateness of televising courses such as English and social studies which are being attempted on a direct instruction basis for the first time in the Cincinnati public schools.

SECTION II

ABSTRACTS OF FOUR EXPERIMENTS IN THE USE OF TELEVISION IN INSTRUCTION CINCINNATI PUBLIC SCHOOLS, 1959-60

Experiment 1 - Abstract of the Results of the Television Experiment in Fifth Grade Science.

The purpose of this study was to determine whether television instruction could significantly raise achievement in fifth grade science above that normally obtained through conventional instruction.

In the study, television instruction was designed for the average ability level. Fifteen schools were involved, each school contributing two classes taught by the same teacher. One class in each school received some instruction by television, while the other did not. The fifteen schools were divided into three ability levels with five school represented in each level. Covariance techniques were used in analyzing the results of the Sequential Tests of Educational Progress, Science Form 4B, administered in March, 1960. The average scores, after appropriate adjustments were made relative to ability level, are shown in Table 1.

Table 1. Criterion Test Averages Adjusted on the Basis of Initial Levels of Ability and the F Ratio Indicating the Significance of Difference Between Methods at Each Ability Level, Fifth Grade Science Television Experiment, Cincinnati Public Schools, 1959-60.

Ability Level	Methods Averages		Difference (TV - Non-TV)	F Ratio
	TV	Non-TV		
Above Average	64.68	64.53	+ .35	.04
Average	52.22	55.00	-2.78	5.60*
Below Average	47.69	50.02	-2.33	6.35*

*Significant below the 1 per cent level.

The differences between television and non-television groups at each of the three ability levels reflect a lack of consistency in the effectiveness of each method. It appears that the conventional classroom method

is significantly better than the television method at the average and below average ability levels. The methods are equally effective at the above average ability level.

In summary, these results are almost identical to those obtained in the 1958-59 sixth grade science experiment. In both experiments conventional instruction was superior to television instruction at the average and below average ability levels, while both methods were equally effective at the above average ability level.

Experiment 2 - Abstract of a Study of the Effectiveness of Pupil Involvement in Learning Elementary Science by Television, Grade 5.

Two different methods of television instruction were used in an experiment conducted in fifth grade science in the Cincinnati public schools during the school year 1959-60. One method strived for the attainment of higher pupil involvement, while another method was designed for a lower level of pupil involvement. The purpose of this experiment was to determine the relative effectiveness in terms of achievement of pupils who were taught by television under the high and low involvement conditions.

Fifteen classes of fifth grade science pupils were taught a unit on energy for a period of nine telecasts every other day under television teaching conditions thought to be conducive to higher pupil involvement. Another fifteen classes of fifth grade science pupils also were taught by television but under television teaching conditions thought to be less conducive to pupil involvement.

Several involvement techniques were used in the telecasts. The most common method was that of asking direct questions without providing the answers and giving sufficient lapse of time following each question so that pupils could react. In addition, pupils were asked by the television teacher to participate in certain activities along with her and were encouraged to bring various science materials to class. Supplementary science books, elaborating upon the subject matter content, were suggested and discussed in the telecasts.

The effectiveness of the two methods was determined through the use of a locally-constructed achievement test covering the unit on energy and

through the administration of a pupil questionnaire regarding reactions to various phases of television instruction.

The conclusions and hypotheses resulting from this study are as follows:

1. Pupil achievement was similar for both the high and low involvement conditions of television instruction. This was true for classes of above average, average, and below average ability. It is hypothesized that a similar experiment of longer duration might show the high involvement condition to be more effective. It is suggested further that pupils taught under the high involvement condition might remember subject matter better than pupils taught under the low involvement condition.

2. Generally, pupil attitudes did not favor the high involvement condition of instruction. Although this statement applied to some extent to pupils at all ability levels, it was most pronounced with the above average pupils. This suggests that different involvement techniques are necessary for pupils of varying ability. This hypothesis seems particularly tenable if it is assumed that involvement is an aspect of intelligence and as such has varying degrees of effectiveness. In the present experiment, the more able pupils may have felt that the involvement techniques simply elaborated the obvious. Another possible reason why high involvement tended to be rejected by pupils is that past conditioning to television may have established it as a medium of passive entertainment rather than active instruction.

3. Classroom teachers of high involvement classes found few instructional differences between the experimental telecasts and the pre-experimental telecasts. Those that did find significant differences tended to prefer the pre-experimental (lower involvement) telecasts.

Experiment 3 - Abstract of the Results of the Television Experiment in Seventh Grade Mathematics.

The purpose of this experiment was to determine whether television could be used more effectively with classes grouped homogeneously with

respect to their achievement in the subject area. Previous experiences indicated that one level of television instruction was ineffective in dealing with the wide range of abilities of all the pupils in a grade. Although television did not seem to favor bright, average, or less able youngsters particularly, nevertheless, each experiment seemed to single out one ability level to which it seemed uniquely favorable. The implication of these experiments was that classes should be grouped homogeneously and that the television instruction in a given course should be planned for the particular group. This experiment was designed with these conditions in mind.

Three schools with four classes in each school were used in the experiment. Within each school each of the two teachers* taught one class by television and another class in the conventional manner. The 1960 edition of the Metropolitan Arithmetic Achievement Test was administered in March as the criterion instrument. The results of this study are shown in Tables 1 and 2.

Table 1. Standard Scores on the Computation Subtest of the Metropolitan Intermediate Arithmetic Achievement Test, Form Bm, for Television and Non-Television Classes Taught by Five Different Teachers, Cincinnati Public Schools, 1959-60.

Teacher	N	TV Averages	N	Non-TV Averages	TV - Non-TV Differences
1	26	245.65	24	242.88	+2.77
2	27	250.96	23	249.43	+1.53
3	23	248.43	31	244.68	+3.75
4	33	252.45	21	250.90	+1.55
5	25	245.32	30	247.67	-2.35

The results of the Problem Solving and Concepts subtest in Table 2 showed a significant interaction between methods and teachers. Individual t-tests showed two of these differences to be significant, both of which favored the television method. It should be noted that both of these

*Due to certain extenuating circumstances, one television class was unable to view telecasts regularly. Both the television and control classes taught by the teacher, therefore, were dropped from the experiment.

significant differences favoring television occurred within the same school. Inquiry revealed that both teachers 2 and 3 and the administrative staff of their school were especially enthusiastic about television instruction. This could be a pertinent factor in explaining these results.

Table 2. Standard Scores on the Problem Solving and Concepts Subtest of the Metropolitan Intermediate Arithmetic Achievement Test, Form Bm, for Television and Non-Television Classes Taught by Five Different Teachers, Cincinnati Public Schools, 1959-60.

Teacher	N	TV Averages	N	Non-TV Averages	TV - Non-TV Differences	t-Ratio
1	26	252.46	23	250.17	+2.29	1.22
2	26	251.65	25	247.48	+4.17	2.34*
3	23	252.74	31	248.52	+4.22	2.40*
4	31	250.84	23	248.57	+2.27	1.34
5	26	247.69	27	250.93	-3.24	1.98

*Significant at the 5 per cent level.

This study reveals that the effective use of television seems to be dependent largely upon the teachers involved. It appears that television instruction is not sufficiently powerful to make the television method superior, independent of the classroom teacher's ability to use television instruction effectively in the classroom. This finding may be explained in part by the fact that only 25 per cent of the total instructional time was devoted to television.

In view of these results, the value of television as used in this study seems to be established to some extent, but not conclusively. It should be noted that the design of this experiment was ideally adapted to television. The fact that the results were not conclusively in favor of television instruction may indicate that (a) the proportion of total instructional time used by television was not sufficiently great to show its effects on the achievement test; (b) teachers with certain attitudes and characteristics are better able to utilize television effectively than some other teachers; (c) that homogeneous grouping of more able pupils for television instruction is a more effective use of television than is television instruction of homogeneously grouped less able pupils; and

(d) that television instruction is not a more effective technique than conventional instruction.

Experiment 4 - Abstract of Follow-Up Study of Pupils in 1957-58 Television Experiment in Biology.

One of the hypotheses set forth by those who have used television in direct instruction is that subject matter retention may be greater in direct instruction than in conventional instruction. If an emphasis is placed on visual perception in contrast to verbal representation as the basis for greater retention, this hypothesis seems tenable. The purpose of this study was to determine whether significant differences exist in the amount of retention of biology by pupils taught by television and those taught in the conventional manner.

The pupils in this follow-up study were those involved in the 1957-58 biology experiment. These pupils, now located primarily in four high schools, were identified and given an alternate form of the Cooperative Biology Test, the same instrument used in the 1957-58 experiment.

Grouping by ability levels did not seem as critical as grouping on the basis of the number of science courses taken since biology. The television and non-television groups, therefore, were divided into three categories: (1) those who have taken no further science courses; (2) those taking one other science course; and (3) those taking two other science courses. Since the initial post-test was given in May, 1958 and the follow-up test given in March, 1960, the time lapse is one year and ten months.

The results of the follow-up test, adjusted for performance on the post-test given at the end of the 1957-58 experiment, are shown in Table 1.

Table 1. Adjusted Follow-Up Scores on the Cooperative Biology Test for Television and Non-Television Groups According to Number of Science Courses Taken, Cincinnati Public Schools, 1959-60.

Number of Science courses taken since Biology	Number of Pupils	TV Group Averages	Number of Pupils	Non-TV Group Averages	Differences TV - Non-TV
0	40	54.99	27	54.60	+.39
1	66	61.22	64	61.52	-.30
2	31	63.86	23	64.31	-.45

Inspection of the difference column shows the differences to be small and easily attributable to chance variation. It was found that not only were the average follow-up scores higher for pupils who took additional science courses, but also the average post-test scores (now shown in the preceding table). This finding shows that pupils who achieve well in biology tend to pursue further science courses.

A comparison of follow-up scores with post-test scores (without adjustments) showed almost no loss of achievement for pupils who took no further science courses and small gains for pupils who took one or two other science courses. This finding was equally true for pupils taught by television or conventional instruction.

The data were analyzed separately for four classes of above average ability whose scores on the final test in 1957-58 significantly favored television. In the present study the difference between the two groups after two years was not statistically significant. The lack of a significant difference was not a matter of a decrease in test score for the television classes, but rather an increase in test score for the non-television group.

The conclusions of this study may be stated as follows:

1. Televised instruction in biology did not result in a greater or lesser degree of retention than conventional instruction when the comparison was made after a lapse of approximately two years.
2. There is some evidence to show that the above average ability pupils taught biology in the conventional manner have a greater potential for transfer of learning than do pupils taught by television.

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